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Glossary for Air Pollution Control of Industrial Coating Operations. Second Edition (With Graphical Aids for Rapid Estimation of Acceptable Compliance Alternatives)

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Common terms used in the air pollution control of emissions from industrial coating operations are defined. The definitions cover both coatings terminology and terms related to the Clean Air Act. Appendices give sample calculations to illustrate emission reductions achieved by changing coatings. Graphical aids which simplify calculations are shown.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Coatings Pollution Control Volatile Organic Compounds	Air Pollution Control	13 B

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Glossary for Air Pollution Control of Industrial Coating Operations

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(With Graphical Aids for Rapid Estimations of Acceptable Compliance Alternatives)

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

December 1983

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PREFACE

Since 1977 the U.S. Environmental Protection Agency has issued a series of guidelines and regulations, the implementation of which will result in large reductions in air pollution emitted by industrial coating operations. The guidelines (referred to as Control Technique Guidelines, or CTG's) are used to apprise the States of reasonably available control technology for major existing sources of volatile organic compounds (VOC's). The Federal regulations are applicable to new or modified sources of pollution and are known as New Source Performance Standards.

This regulatory activity has meant that industries must become familiar with regulatory terms from the Clean Air Act, and State and local agencies must learn terminology from the coatings industry. This glossary is an attempt to aid both groups by listing the most common terms which will be used by both in the application of air pollution control to paints and coatings. The goal is for local control agents and industry representatives to be able to speak a common language as they try to mutually solve the problems of controlling air pollution from industrial coatings.

Also included as Appendices are example calculations which illustrate important coating concepts. Appendix A illustrates the effect of changes in coating solids or transfer efficiency on the amount of VOC which will be emitted from a coating operation. Appendix B contains two charts which permit rapid manipulation of the various units used to describe the solvent content of coatings. Figure B-1 allows rapid calculation of the solvent content of any of three major types of coatings when the volume percent solids is known. Figure B-2 allows a quick estimation of the emission reduction achieved when a coating with lower solvent content is substituted for one which contains more solvent. Appendix C provides practical examples of how Figures B-1 and B-2 may be used to determine the possible compliance alternatives available to a coater.

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Glossary of Terms

Absorption - The unit operation in which one or more soluble components of a gas mixture are dissolved in a liquid.

Add-on control device - An air pollution control device such as carbon adsorber or incinerator which reduces the pollution in an exhaust gas. The control device usually does not affect the process being controlled and thus is "add-on" technology as opposed to a scheme to control pollution through making some alteration to the basic process.

Affected facility - With reference to a stationary source, any apparatus to which a standard is applicable.

Air dry - A coating which dries or cures at ambient temperature.

Air spray - Spray coating method in which the coating is atomized by mixing it with compressed air.

Airless spray - Spray coating method in which the coating is atomized by forcing it through a small opening at high pressure. The liquid coating is not mixed with air before exiting from the nozzle.

ALAPCO - Association of Local Air Pollution Control Officials.

Aliphatic compounds - Organic compounds composed of open chains of carbon atoms. These include paraffins and olefins, but not aromatic compounds.

Alternative method - Any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated to the Administrator's satisfaction to, in specific cases, produce results adequate for his determination of compliance.

Anodic electrodeposition - Electrodeposition in which the part being painted is wired to serve as the anode or electron donor. This was the first type of electrodeposition developed, but has been largely replaced by cathodic electrodeposition which gives better corrosion protection.

Applied solids - Solids which remain on the substrate being coated or painted.

Architectural coatings - Stock type or shelf coatings which are formulated for service under environmental conditions, and for general

application on new and existing residential, commercial, institutional, and industrial structures. These are distributed through wholesale - retail channels and purchased by the general public, painters, building contractors, and others.

Aromatic solvent - Solvents made of compounds that contain an unsaturated ring of carbon atoms, typified by benzene's structure. Xylene and toluene are aromatic solvents often used in coatings.

Attainment area - An area which is considered to have air quality as good as or better than the national ambient air quality standards, as defined by Section 107 of the Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others.

Automatic electrostatic spray application - Electrostatic spray applied by a robot or other self-acting mechanism. Automatic electrostatic spray can be a very effient way to transfer coatings to the substrate thus reducing pollution which otherwise would result from wasted paint overspray.

BACT - "Best available control technology" - an emission limitation based on the maximum degree of emission reduction which (considering energy, environmental, and economic impacts and other costs) is achievable through application of production processes and available methods, systems, and techniques. In no event does BACT permit emissions in excess of those allowed under any applicable NSPS or NESHAP. It is applicable on a case-by-case basis for each major new (or modified) emission source to be located in areas attaining the National Ambient Air Quality Standards. It applies to each pollutant regulated under the Act, and is concerned with Prevention of Significant Deterioration (PSD). See Sections 165(a)(4) and 169 of the Clean Air Act.

Baking temperatures - The recommended temperatures for operation of the curing oven in which a coated part is baked or cured to obtain optimum properties. The amount of volatile material released from the coating can sometimes increase if baking temperature is increased.

Banking - A system for recording qualified emission reductions for later use in bubble, offset, or netting transactions.

Base coat/Clear coat - A two step finish coat system in which a highly pigmented, often metallic, basecoat is followed by a thicker clear coat. It reportedly results in a finish with high gloss characteristics.

Bell - An electrostatic spray device in which the paint applicator is shaped like a bell. This bell revolves rapidly so that paint, metered to the center of the bell, is thrown by certifugal force off of the edge as a fine mist. High electrostatic voltage maintained on the bell also contributes to keeping the paint spray a fine mist. This fine mist allows electrostatic forces to

draw the paint to the part being coated very efficiently with very little overspray. The bell is one of the most efficient pieces of spray equipment with transfer efficiencies commonly over 90 percent. When high bell speeds are used (over 30,000 revolutions per minute) then high solids coatings may be sprayed more easily than with other types of spray equipment.

Beverage can - A can used for soft drinks or beer.

Binder - Nonvolatile portion of the liquid portion of a coating. When the paint dries, the binder becomes part of the solid film, binding the pigment particles together and cementing the paint film to the substrate over which it is applied.

Blushing - A film defect appearing as a milky opalescence which sometimes appears as the film or lacquer dries. It is often caused when the rapid solvent evaporation cools the surface and causes moisture from the air to condense on the wet coating. This condition is commonly encountered in the wood furniture industry.

Bubble - A system under which existing sources can propose alternative means to comply with a set of emission limitations. Under the bubble concept, sources can control more than required at one emission point where control costs are relatively low in return for a comparable relaxation of controls at a second emission point where costs are high. The bubble policy was first announced in the Federal Register December 11, 1979 (44 FR 71779), and changes were proposed on April 7, 1982.

Capture - The containment or recovery of emissions from a process for direction into a duct which may be exhausted through a stack or sent to a control device. The overall abatement of emissions from a process with an add-on control device is a function both of the capture efficiency and of the control device.

Capture device - A hood, enclosed room, floor sweep or other means of collecting solvent or other pollutants into a duct. The pollutant can then be directed to a pollution control device such as an incinerator or carbon adsorber. Sometimes the term is used loosely to include the control device.

Capture Efficiency - The fraction of all organic vapors generated by a process that are directed to an abatement or recovery device.

Carbon Adsorber - An add-on control device which uses activated carbon to absorb volatile organic compounds from a gas stream. The VOC's are later recovered from the carbon, usually by steam stripping.

Cast coating - a film made by depositing a layer of plastic material in solution, in a dispersion or in a molten state onto a (usually) smooth solid surface. The plastic is solidified and removed from the surface as a film having the same type of surface as the solid surface on which it was formed.

Catalytic incinerator - A control device which oxidizes VOC by using a catalyst to promote the combustion process. The catalyst allows the combustion process to proceed at a lower temperature (usually around 600°F to 800°F) than a conventional thermal incinerator would require (1,100 to 1,400°F), resulting in fuel savings and lower cost incineration.

Cathodic electrodeposition - An electrodeposition paint application technique where the part being painted is the cathode. Cathodic electrodeposition gives superior corrosion resistant coatings and has largely replaced the older anodic processes. Cathodic electrodeposition is often used to apply automobile primers.

Cellosolve - Proprietary name for Union Carbide's brand of monoethyl ether of ethylene glycol, $C_2H_5OCH_2CH_2OH$, a commonly used solvent for water borne coatings. It is also their generic name for a series of ethers of similar type such as methyl cellosolve and butyl cellosolve.

Cellulosic coating - A coating in which a large portion of the solids are made up of chemically treated cellulose. Cellulose lacquers are widely used in the wood furniture industry for topcoats.

Chalking - Formation of a powder on the surface of a paint film caused by disintegration of the binding due to weathering.

Clean Air Act - The Clean Air Act, as amended, provides the foundation for EPA's efforts to improve air quality. The Clean Air Act, building on earlier legislation, was passed in 1970, and was amended in 1977.

Clear coat - A transparent coating usually applied over a colored opaque coat to give improved gloss and protection to the color coat below. In some cases a clear coat simply refers to any transparent coating without regard to the substrate.

Chlorinated solvent - An organic solvent which contains chlorine atoms as part of the molecular structure. For example, methylene chloride and 1,1,1 - trichloroethane, the most common, are used in aerosol spray containers and in traffic paint. Certain chlorinated solvents are exempt from some air pollution regulations because of their low photochemical reactivity.

Coating - A protective or decorative film applied in a thin layer to a surface. This term often applies to paints such as lacquers or enamels, but also is used to refer to films applied to paper, plastics or foil.

Coating application station - The part of a coating line where the coating is applied. In a spray operation it is the spray booth and is distinquished from the flash off area and oven.

Coating head - The coating applicator in a roll coater, rotogravure coater or knife coating operation.

Coating solids - The part of the coating which remains after the coating is dried or cured.

Coil coating - A very efficient metal coating operation in which sheet metal is unwound from a coil, roller coated and rewound. The metal may then be formed into products such as aluminum siding, automobile parts or a variety of other items.

Compliance coating - A coating whose volatile organic compound content does not exceed that allowed by regulation. Compliance coatings may be water borne, low solvent (higher solids) or powder.

Compliance schedule - A negotiated agreement between a pollution source and a government agency that specifies dates and procedures by which a source will reduce emissions and, thereby, comply with a regulation.

Condensation - A method of solvent recovery in which the vaporized solvent is liquified generally by cooling.

Control - In the air pollution field, this means the abatement of pollutants which might be exhausted into the atmosphere. It often refers to the collection or destruction efficiency of an add-on device such as an incinerator or carbon adsorber as opposed to capture of the pollutants into the device.

Control device - Any equipment which reduces the quantity of a pollutant that is emitted to the air. The device may destroy or secure the pollutant for subsequent recovery. Examples are incinerators, carbon adsorbers and condensers.

Control device efficiency - The ratio of the pollution released by a control device and the pollution introduced to the control device expressed as a percentage.

Control Technique Guidelines (CTG) - A series of documents prepared by EPA to assist States in defining reasonable available control technology (RACT) for major sources of volatile organic compounds (VOC). The documents provide information on the economic and technological feasibility of available techniques; and, in some cases, suggest limits on VOC emissions.

Cowtail - Small marks of paint applied to wood furniture to give an antique effect.

Cratering - A paint film imperfection which appears as tiny depressions in the surface.

Criteria pollutant - A pollutant for which a criteria document has been issued as described by Section 108 of the Clean Air Act. Criteria pollutants are nitrogen oxides, sulfur oxides, ozone, particulate matter, and carbon monoxide. A National Ambient Air Quality Standards (NAAQS) exists for each criteria pollutant.

CTG - A Control Technique Guideline.

Cure volatiles - Reaction products which are emitted during the chemical reaction which takes place in some coating films at the cure temperature. These emissions are other than those from the solvents in the coating.

Curing oven - A heating chamber where wet paint solidifies either by drying or by chemical cross linking of the paint film.

Designated pollutant - A pollutant which is not a criteria pollutant (as described in Section 108 of the Clean Air Act) nor a hazardous air pollutant (as defined in Section 112 of the Clean Air Act) but for which new source performance standards exist. States are required to control these pollutants under Section 111d of the Clean Air Act. Designated pollutants are acid mist, total reduced sulfur (TRS), and fluorides.

Disk - An electrostatic spray application device which consists of a rapidly spinning metal disk onto which paint is fed. The paint is slung off the edge of the rotating disk by centrifugal force and the paint is formed into a fine mist. This device applies paint with high transfer efficiency.

Distress - A mechanical deforming of the surface of a piece of wood furniture during the coating process to give an antique appearance.

Dip coating - Method of applying a coating in which the substrate is dipped into a tank of coating and then withdrawn.

Doctor blade - Method of applying a coating in which a flat metal strip or blade is mounted such that it scrapes off excess coating from a roll or rotogravure coater before the coater contacts the paper or other substrate being coated.

EDP - See Electrodeposition.

Elastomer - A natural or synthetic polymer which has rubber-like properties.

Electrocoat - See Electrodeposition.

Electrodeposition - Dip coating method in which an electrical field is used to promote the deposition of the coating material onto the part. The part being painted acts as an electrode which is oppositely changed from the particles of paint in the dip tank.

Electron beam - A method of curing coatings which uses high energy radiation to cross-link polymers.

Electrostatic spray - A method of applying a spray coating in which opposite electrical charges are applied to the substrate and the coating. The coating is attracted to the object by the electrostatic potential between them.

Elpo - See Electrodeposition.

Emission reduction - The decrease in VOC emitted when (1) a low solvent coating is used in place of a higher solvent coating or (2) an add-on control device (such as carbon adsorber or incinerator) is used on a process. Emission reduction is often expressed as a percentage. Figure B-2 in Appendex B allows rapid estimation of the percent reduction when one coating is substituted for another.

Emulsion - A two phase liquid system in which small droplets of one liquid are uniformly dispersed throughout the second.

Enamel - A coating that cures by chemical cross-linking of its base resin. Enamels ca be readily distinguished from lacquers because enamels are not resoluble in their original solvent.

End sealing compound - A viscous coating used to form a seal or gasket between the end of a can and the can body.

Equivalent method - Any method of sampling and analyzing for an air pollutant which has been demonstrated to the Administrator's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specific conditions.

Exempt solvent - Specified organic compounds that are not subject to the requirements of a regulation. Such solvents that have been deemed of negligible photochemical reactivity by EPA are: methane, ethane, 1,1,1-trichloroethane (methyl chloroform), methylene chloride, trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), chlorodifluoromethane (CFC22), trifluoromethane (FC-23), trichlorotrifluoroethane (CFC-113), dichlorotetrafluoroethane (CFC-114), and chloropentafluoroethane (CFC-115).

Existing source - Any stationary source of air pollution other than a new source.

Exterior basecoat - A coating applied to the outside of a beverage can to provide both corrosion resistance and as a background for lithography or printing.

Face velocity - The velocity of air through a paint spray booth. Where people are working, health regulations usually require this velocity to be at least 100 feet per minute. When electrostatic spraying is used a face velocity of 60 feet per minute is permitted.

Fabric coating - A process which applies a uniform layer of polymeric resin on a supporting fabric substrate. Typical coatings are rubbers, urethanes, vinyls, and acrylics.

Fabric printing - A process which applies a decorative, usually multicolored pattern on a fabric substrate.

Filler - A thick coating applied to wood furniture to fill large pores in the wood.

Film former - The part of a coating that remains on the substrate after the cure. Some film formers may be liquid but polymerize to form a solid when the coating is baked to the requisite curing temperature.

Film thickness - The thickness of the dry cured coating on the substrate. Film thickness varies with application, but coatings on metal generally range from 0.5 to 4 mils.

Flashoff zone - The area within a plant where solvents evaporate from a coating during the interval between coats or before the painted object enters a bake oven.

Flat screen printer - A semicontinuous process for printing on fabric. The fabric is placed on a belt, the belt and fabric are moved into position under the flat screen, and the belt is stopped. The flat screen, on which print paste has been applied is mechanically lowered onto the fabric. A squeegee moves across the screen forcing print paste through a pattern onto the fabric. The screen is then raised and the fabrics and belt are indexed to the next position to receive another screen and another color on the pattern.

Flexible packaging - Use of paper, aluminum foil, cellophane or plastic films either singly or in combination to produce bags, pouches, and wraps for consumer and industrial products. The flexible package will typically be less than 50 micrometers (0.002 inches) thick and will usually conform to the shape of the item(s) it contains.

Flexible vinyl products - Those products composed of a supported or nonsupported vinyl sheet or coating and more than 50 micrometers (0.002 inches) thick. This term does not include vinyl resilient floor coverings.

Flexography - A method of printing in which the image areas are raised above the non-image areas. The image carrier is made of rubber or other elastomeric material.

Floor sweep - A vapor collection duct designed to capture vapors which are heavier than air and which collect along the floor.

Flow coat - Method of applying coating to an object in which the coating is poured on the object.

Fluidized bed coating - A powder coating technique in which the powder is applied by lowering the part to be coated into a fluidized container of powder. The powder is "fluidized" by blowing air through the powder from the bottom of the container.

Fly speck - Small spots of paint that are sprayed onto wood furniture to create an antique affect.

Freedom of information request - A request for information from a Federal government agency pursuant to the Freedom of Information Act.

Fugitive emissions - Emissions not caught by a capture system.

General provisions - Subpart A of part 60 - Standard of Performance for New Stationary Sources in 40 CFR 60. This subpart contains instructions on monitoring and recordkeeping and definitions of terms generally used in the program for development of new source performance standards.

Glaze - Small amount of color coating added to wood furniture to highlight and give character to the wood. These are often manually wiped to remove most of the color.

Gloss - A property of paints and enamels which can be characterized by measuring the specular reflectance of the film using ASTM test D 523-67 (1972) Test for Specular Gloss. The 60-degree specular gloss test is used for all except flat paints. A measurement of 65 or more characterize the material as "gloss". Semigloss paints are those with readings between about 30 to 65; "flats" when tested at an 85 degree angle have readings below 15.

Grain raising - Swelling of the fibers of wood caused by absorbed liquids, especially water. Grain raising causes the surface of wood to look and feel rough.

Handheld electrostatic - A hand held spray gun which uses electrostatics to improve efficiency. This application gives higher transfer efficiency than nonelectrostatic hand held spray.

Hazardous pollutant - An air pollutant to which no ambient air quality standard is applicable and which causes or contributes to air pollution which may reasonably be anticipated to result in an increase in serious irreversible or incapacitating reversible, illness. This definition is given in Section 112 of the Clean Air Act. Hazardous pollutants include asbestos, mercury, beryllium, benzene, arsenic, vinyl chloride and radionuclides.

Higher-solids coatings - Paints containing considerably higher solids than has been conventional in the past. Usually paints with greater than 60 percent solids by volume are considered higher solids coatings although the term is often applied to any coating which meets any of EPA's Control Technique Guidelines. Formerly, under California's Rule 66, a high solids paint is one containing not less than 80 percent solids by volume.

Hood - A partial enclosure or canopy for capturing and exhausting, by means of a draft, the organic vapors or other fumes rising from a coating process or other source.

Hood capture efficiency - The emissions from a process which are captured by the hood and directed into the control device, expressed as a percent of all emissions.

Hot melt adhesive - Adhesive which is applied in a molten condition and cools rapidly to form a solid. Hot melt adhesives contain little or no volatile organic solvents.

Hydrocarbon - An organic compound consisting only of carbon and hydrogen. Sometimes the term hydrocarbon is used loosely (but incorrectly) to refer to any organic compound.

Infrared (I. R.) - Electromagnetic radiation of wave lengths between 0.78 and 1.0 micrometer (780 to 1000 nanometer) sometimes used to cure coatings.

Inside spray - Coating applied (sprayed) on the inside of cans to provide a protective film between the contents of the can and the can body.

Isocyanate - A compound containing the functional group, -N=C=O. These functional groups may be crosslinked with a hydroxyl containing material to form urethane polymers which are often used in coatings.

Knife coater - A coater used primarily for paper or fabric webs which employs an adjustable blade or "knife" to distribute a liquid coating evenly over a moving web surface.

LAER - "Lowest achievable emission rate" - Pursuant to Section 171(1) of the Clean Air Act, LAER is that rate of emissions which reflects:

(a) the most stringent emission limitation which is contained in the implementation plan of any State for such class or category of sources, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable; or

(b) the most stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent.

In no event, however, shall the application of this term permit a proposed new or modified source to emit any pollutant in excess of the amount allowable under applicable new source standards of performance. Areas of the country that have not attained national ambient air quality standards may require LAER on new sources of pollution.

Lacquer - A coating which dries primarily by solvent evaporation, and hence is resoluble in its original solvent.

Lamination - The process of adhering two web surfaces together to form a single composite material. Paper, fabric, foil and plastic film may be laminated to each other.

Latex - A dispersion of rubber, synthetic resin or polymers used in paints, adhesives, or coatings.

LEL - See lower explosive limit.

LEL Meter - A device used to measure the concentration of combustible vapors in an air sample.

Less water - A term used by the Environmental Protection Agency in its series of Guidelines to the States on development of regulations for the coating industry and subsequently adopted by many States in their regulations. The term usually appears in the expression "pounds of volatile organic compound per gallon of coating (less water)".

Letter press - A method of printing in which the image areas are raised above the background area. The mechanism which transfers the image is made of metal or other relatively hard material.

Lithography - See off-set lithography.

Lower Explosive Limit - (LEL) - The concentration of a compound in air below which a flame will not propagate if the mixture is ignited.

Low-solvent coating - A coating which contains a lower amount of volatile organic compound (VOC) than conventional organic solvent borne coatings. Low solvent coatings usually fall into the three major groups of higher solids, waterborne or powder coatings.

Magnet wire - Wire used in equipment such as electrical motors, generators and transformers. Magnet wire is coated with an electrically insulating varnish or enamel.

Maintenance coatings - Coatings used for bridges, chemical plants and other heavy duty industrial type applications.

Major modification (with respect to Prevention of Significant Deterioration and New Source Review) - This term is defined as in Section 111 of the Clean Air Act with two changes: (1) includes only modifications to major stationary sources and (2) provides significant pollutant increase levels below which a modification is not considered major. (See Section 111 (a) of the Clean Air Act, 40 CFR 51.24(b)(2), (23); 52.21(b) (2), (23); and 51.18(j) (vi), (viii)).

Major stationary source - This term is used to determine the applicability of prevention of significant deterioration (PSD) and nonattainment new source review regulations. In a nonattainment area, any stationary source that has the potential to emit more than 100 tons per year is considered a major stationary source. In PSD

areas, the cut-off level maybe either 100 or 250 tons per year depending on the type of source. (See Subsection 169 and 302(j) of the Clean Air Act and 40 CFR Section 51.24(b)(1), 52.21 (b)(1), and 51.18(j)(1)(i)-(vi)).

Make-up air - Fresh air drawn in from outside the plant to replace the dirty solvent laden air from a coating operation or drying oven that is exhausted from the building. This make-up air must be heated in the winter to room temperature or even to oven temperature, thus accounting for a large energy usage.

Make-up solvent - Portion of solvent required to compensate for the amount lost, normally via evaporation, during a manufacturing process.

Manufacturer's formulation - A list of substances or component parts of coatings as described by the maker of the coatings. This may be used, in many cases, to calculate the volatile organic compound content of a coating.

Marine paint - A coating used on ships or boats.

Material balance - A calculation based on conservation of mass, i.e., the amount of material going into a process is equal to the amount which leaves the process. This relationship is often used to estimate solvent losses from coating operations.

Metallic paint - Paint containing tiny flecks of aluminum or other metal often used for painting automobiles because of the attractive appearance of the paint.

Method 18 - An EPA test method which uses gas chromatographic techniques to measure the concentration of individual volatile organic compounds in a gas stream.

Method 24 - An EPA reference method to determine density, water content and total volatile content (water and VOC) of coatings. (40 CFR Part 60 Appendix A)

Method 25 - An EPA reference method to determine the VOC concentration of a gas stream. (40 CFR Part 60 Appendix A)

Metric ton - A unit of weight equivalent to 2,204.6 pounds or one megagram (10^6 grams).

Mini-bell - An electrostatic spray application device using a rapidly rotating bell to atomize paint. The bell is of small diameter giving rise to the name mini-bell.

Mil - A unit of length equal to one thousandth of an inch.

Miscellaneous metal parts - As used in the Environmental Protection Agency's Control Technique Guidelines, any metal parts excluding

description of a typical but theoretical plant used for developing economic, environmental impact, and energy impact analyses as support for regulations or regulatory guidelines. It is an imaginary plant the parameters of which are typical of existing or future plants. The parameters are used to estimate the cost of incorporating air pollution control technology as the first step in exploring the economic impact of a potential NSPS. Such analyses are a fundamental part of the development of a standard, as recorded in the Background Information Document.

Modified source - An existing facility in which a physical change in the facility, or a change in method of operation, increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.

Monomer - The starting compound for a polymerization reaction.

NAAQS - National Ambient Air Quality Standards are developed by EPA pursuant to Section 109 of the Clean Air Act. They are standards which, in the judgement of the Administrator of EPA, must be attained and maintained in order to protect the public health, with allowance for an adequate margin of safety. "Secondary" NAAQS similiarly specify a level necessary to protect the public welfare. NAAQS exist for nitrogen oxides, sulfur oxides, particulate matter, ozone and carbon monoxide.

NAPCTAC - "The National Air Pollution Control Techniques Advisory Committee", a group constituted pursuant to § 117 of the CAA consisting of representatives from industry, universities, local air pollution control agencies, and environmental groups. The committee meets at the request of the Agency to assist in the development of NSPS and NESHAP's.

Naphtha - Any of several hydrocarbon solvents, or their mixtures, which are derived from petroleum products or coal tar. These may be composed of aliphatic or aromatic compounds.

NESHAP - National Emission Standards for Hazardous Air Pollutants, regulations as defined in Section 112 of the Clean Air Act which regulate asbestos, mercury, beryllium, benzene, arsenic, vinyl chloride, radionuclides and any other substance for which no ambient air quality standard is applicable and which in the judgement of the EPA Administrator may cause an increase in mortality, or an increase in serious irreversible or incapacitating reversible illness. (40 CFR Part 61)

New source - Any stationary source the construction or modification of which commences after the publication of regulations or proposed regulations which prescribe a standard of performance which is intended to apply to that type of air pollution emission source.

New source performance standards - see NSPS.

NGR stain - Non-grain raising stain used on wood furniture. These are usually organic borne because of the tendency of water to cause the grain of wood to swell.

Nonattainment area - An area, as defined under Section 107 of the Clean Air Act, which is in violation of one or more of the national ambient air quality standards.

NSPS - New source performance standards, i.e. standards for emission of air pollutants from new, modified or reconstructed stationary emission sources which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the administrator determines has been adequately demonstrated. The Clean Air Act usually refers to these as standards of performance for new stationary sources.

OAQPS - The Office of Air Quality Planning and Standards, a part of the U.S. Environmental Protection Agency.

Offset lithography - A method of printing in which the image area of the printing roll is essentially at the same level as the nonimage area. The ink wets the image area only and the nonimage area is wetted by water. Ink is transferred from the printing roll to the rubber surface on a roll called the blanket cylinder which transfers the ink to the paper. When a web or continuous roll of paper is used, the process is called "web offset."

Olefins - A class of unsaturated aliphatic hydrocarbons having one or more double bonds. The double bond makes these compounds highly chemically reactive and useful as starting materials for the manufacture of other compounds. Examples are ethylene and propylene.

Orange peel - A paint surface appearance, characterized by small pits, resembling the surface texture of an orange. Depending on the product, this may be desirable (appliances) or highly undesirable (automobiles).

Organic aerosol - Fine organic particles or droplets which remain dispersed in the atmosphere.

Organisol - A thick coating consisting of resin and plasticizers and some organic solvent which is often used to coat flexible substrates such as paper or fabrics. It is similar to a plastisol except that an organisol contains more organic solvent.

Oven - Enclosed area in which a coating is heated and baked or cured.

Overall control - The product of the capture efficiency and the control device efficiency gives an overall control efficiency for the process.

Overspray - That solids portion of a coating sprayed from a spray applicator which fails to adhere to the part being sprayed. (Applied solids plus overspray solids equal total coating solids delivered by the spray application system.)

Overvarnish - Coating applied over the ink on the outside of beverage cans to provide gloss and protect the can from corrosion and abrasion.

Oxygenated solvent - An organic solvent containing oxygen as part of the molecular structure. Alcohols and ketones are oxygenated compounds often used as paint solvents.

Ozone - An oxygen molecule composed of three oxygen atoms. It is a component of photochemical smog and its concentration in the air is regulated by pollution control laws. It is a pollutant which meets the criteria of Section 110 of the Clean Air Act.

Paper coating - As used in Environmental Protection Agency's control technique guidelines, is the coating of paper, plastic film or metallic foil usually with a roll, knife, or rotogravure coater.

Percent capture - The ratio of solvent vapors collected into the capture system to the amount of solvent vapors released by a process expressed as a percentage.

Photochemical oxidant - Ozone and smaller amounts of other irritating chemicals such as peroxyacetyl nitrate which are products of atmospheric reactions of volatile organic compounds, NO_x and sunlight. Photochemical oxidants are a major portion of the air pollution commonly known as "smog".

Photochemical reactivity - Measure of the rate at which an organic compound reacts in the presence of ultraviolet radiation to form photochemical oxidants.

Pigment - A finely ground insoluble powder dispersed in a coating to give a characteristic color.

Pinhole - An imperfection in a paint film which resembles a hole caused by penetration with a pin.

Plasticizer - A substance added to a polymer composition to soften and add flexibility to the product.

Plastisol - A coating made of a mixture of finely divided resin and a plasticizer. It is applied as a thick gel which solidifies when heated.

Precursor - In photochemical terminology, a compound such as a volatile organic compound which "precedes" oxidant. Precursors react in sunlight to form ozone or other photochemical oxidants.

Pressure sensitive adhesive - An adhesive which, when placed on a backing material, adheres to another surface on contact without wetting, heating or adding a curing agent.

Primary heat recovery - A method of conserving energy by using heat from incinerator exhaust gases to preheat the inlet gases to the incinerator.

Primer - First layer of coating applied to a surface.

Primer surfacer - A coating, usually applied over a thin primer, which gives "body" to the surface, fills in irregularities and unlike the primer, is intentionally thick enough to permit sanding without cutting through to bare metal. A topcoat is applied over a primer surfacer.

Pot life - The amount of time a paint may be stored before it hardens and can no longer be used. This usually refers to catalyzed or "two component" coatings which may have a pot life of only a few hours after the two components are combined.

Powder coating - A coating applied as a dry powder which, when baked at sufficiently high temperature, flows out to form a continuous film.

Print paste - A pigmented coating used to render designs on fabric, usually applied by the roller, rotary screen or flat screen printing processes. Mineral spirits are the solvent in print pastes.

Promulgation - The publication of a final rule in the Federal Register. Promulgation is preceeded by a formal proposal published in the Federal Register and an intervening public comment period.

Proposal - The publication of a rule in a preliminary (not final) form in the Federal Register. Usually comments are invited from the affected public, and the final rule is promulgated only after these comments are considered.

PSD - Prevention of Significant Deterioration refers to regulations requiring preconstruction review of major new sources and major modifications locating in attainment or unclassified areas (clean air areas). The requirements are outlined in 40 CFR 52.21, 40 CFR 51.24, and Part D of the Clean Air Act. The objective of the PSD program is to assure that areas of the country that are relatively free from air pollution remain that way.

RACT - "Reasonably available control technology" - the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. RACT is usually applied to existing sources in nonattainment areas and in most cases is less stringent than new source performance standards.

Radiation cure - Method of curing or drying coatings by exposure to electromagnetic waves or particles such as infrared, ultra-violet, or electron beam.

Reactive compound - A volatile organic compound which is a precursor, i.e., reacts in the atmosphere to form photochemical oxidants. Almost all organic compounds are photoreactive, but a few have such low reactively that they are usually considered nonreactive. Solvents that have been deemed of negligible photochemical reactivity by EPA are: methane, ethane, 1,1,1-trichloroethane (methyl chloroform), methylene chloride, trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), chlorodifluoromethane (CFC-22), trifluoromethane (FC-23), trichlorotrifluoroethane (CFC-113), dichlorotetrafluoroethane (CFC-114), and chloropentafluoroethane (CFC-115).

Reconstructed source - An existing facility in which components are replaced to such an extent that the fixed capital cost of the new components exceed 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility. New source performance standards may be applied to sources, which are reconstructed after the proposal of the standard if it is technologically and economically feasible to meet the standard.

Recovered solvent - Solvent which is extracted from a process or exhaust stream usually by adsorbtion or condensation.

Reducing solvent - A solvent added to dilute a coating usually for the purpose of lowering the coating's viscosity.

Reference method - Any method of sampling and analyzing for an air pollutant which is published in Appendix A of 40 CFR 60.

Regulatory alternative - Any of several air pollution control strategies or options that are considered during the development of a regulation. Each such alternative is evaluated in terms of cost of control and economic impact on the industry.

Release coating - A coating applied to a substrate (usually a flexible one) which limits the adherence of a pressure sensitive coating. This is used as a covering sheet for pressure sensitive labels so that the labels can be pulled off and used. The back side of adhesive tapes are coated with release coating to allow the tape to be unrolled.

Reverse roll coater - A roll type coater for paper, film, foil and metal coil which applies coating to the web by a roll which turns in a reverse direction to the direction of travel of the web. This procedure is said to reduce striations in the coating.

Roll coating (Roller coating) - Method of applying coating to a flat sheet or strip in which the coating is transferred by a roller or series of rollers.

Rotary screen printer - A widely used fabric printing technique in which a moving fabric web passes in contact with a series of rotating drums. The cylindrical drums have holes in the drum surface in the shape of a pattern. Liquid print paste is forced through the holes in the drum surface onto the fabric, leaving a pattern on the fabric surface.

Rotational electrostatic spray - A spray paint device which uses a rotating bell or disk to shear the paint into a fine mist and which efficiently draws the paint onto the part being painted by electrostatic forces.

Rotogravure - A method of printing in which the image areas of the printing roll are recessed relative to the background. The image is in the form of cells or cups mechanically or chemically etched in the surface. Typically, a gravure cell is 35 microns deep by 125 microns square, with 22,500 cells in the square inch.

Rule 66 - An air pollution regulation passed by the Los Angeles Air Pollution Control District in 1966. This regulation was aimed at controlling hydrocarbons and defined certain types of compounds as unreacting and exempt from control. This was one of the first VOC regulations, was very influential and was widely copied by other jurisidictions.

Salt spray test - A test to determine corrosion resistance of paints by exposing a standardized steel panel to a salt (sodium chloride) solution fog. The length of time until the panel corrodes gives a measure of corrosion resistance of the paint.

Sealer - A coating used to seal the pores of a surface, especially a wood surface, before additional coats of paint or varnish are added.

Secondary heat recovery - Use of heat from an incinerator exhaust for uses within a plant such as heating an oven or a room. This is distinguished from primary heat recovery which is the use of the hot incinerator exhaust gases to heat the inlet gases to the incinerator.

Section 111 - A section of the Clean Air Act which requires development of standards of performance for new stationary sources (new source performance standards).

Section 111d - A part of Section 111 of the Clean Air Act that regulates emissions of noncriteria and nonhazardous air pollutants (which are the so called "designated pollutants"). After EPA issues an NSPS for a new source category, state air agencies must submit to EPA a plan to control emissions of designated pollutants from existing sources in that category.

Section 112 - A section of the Clean Air Act which requires development of national emission standards for hazardous air pollutants.

Section 114 - A section of the Clean Air Act giving the Environmental Protection Agency authority for information gathering, inspections, and monitoring and provides for EPA personnel to have access into plants with air pollution emissions.

Shade - A color coat used on wood furniture which gives character to the finish. It is often applied by hand wiping with a rag.

SIC code - Standard Industrial Classification, a numerical identification system developed by the U. S. Government for statistical purposes and widely used by business firms. Industries are grouped into similiar categories and each category is given a number representing the category.

Side seam sealer - A compound for protecting the side seam of three piece cans.

SIP - State Implementation Plans are required by Section 110 of the Clean Air Act, as amended. Each State is to submit a plan to the EPA Administrator which provides for implementation, maintenance, and enforcement of the national ambient air quality standards.

Smog - A common name for the visible haze which results from air pollution containing photochemical oxidants.

Speciality printing - Printing on such items as food packages and other than printing of publications.

Spray booth - An enclosed, ventilated area used for spray painting.

Solvent - A liquid used in a paint or coating to dissolve or disperse film-forming constituents and to adjust viscosity. It evaporates during drying and does not become a part of the dried film.

Solvent density - The weight per unit volume of a solvent or solvent mixture. This number is often used in calculating the VOC emissions from coatings. Densities of common organic solvents range from 6.6 lb/gal to 9.5 lb/gal. The Environmental Protection Agency has chosen 7.36 lb/gal as an average density of a coating solvent mixture to use in some calculations.

Solvent borne coating - Coatings which contains only organic solvents. If water is present, it is only in trace quantities.

Stain - A wood coating which is used to give color to wood. Stains usually have low solids and high solvent content, i.e., often greater than 95% solvent by volume.

Standards of performance - Standards for emission of air pollutants from new, modified or reconstructed stationary emission sources which reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction)

the administrator determines has been adequately demonstrated. These are also commonly known as new source performance standards (NSPS).

STAPPA - State and Territorial Air Pollution Program Administrators.

Substrate - The surface to which a coating is applied.

Surface coating operation - The application of a film which covers the surface of some object. Painting and varnishing are common surface coating operations as are coatings applied to fabric, paper, plastic film and metallic foil.

Surfacer - A coating applied over a primer to provide a uniform surface thick enough to permit some sanding before application of a topcoat. Surfacer is also known as primer surfacer.

Textile printing - The decorative enhancement of cloth by applying a pattern or colored design with inks, dyes, or print pastes. The design is usually applied by roller, flat screen or rotary screen techniques.

Theoretical VOC content - The quantity of VOC which will be released during application, flashoff and cure per unit volume of coating (or coating solids).

Thermal incinerator - A device for oxidizing waste material via flame and heat. This contrasts with a catalytic incinerator which incorporates a catalyst to aid the combustion.

Thinner - A liquid used to reduce the viscosity of a coating and which will evaporate before or during the cure of a film.

TLV - Threshold Limit Values (TLV) represent the air concentrations of chemical substances to which it is believed that workers may be daily exposed without adverse effect.

Topcoat - The last coat applied in a coating system.

Total enclosure - An enclosure around the coating head of a web coating line or other coating application device so that all volatile organic compounds (VOC) from the coating application and flashoff operations are collected and ducted through a stack or into the oven. With a total enclosure on a coating line there will be no fugitive emissions, only stack emissions. Some air pollution regulations may require a total enclosure so that all VOC emitted by the process can be measured.

Total organic compound (TOC) - Those compounds measured according to the procedures in an applicable test method.

Touch-up coating - Often, after a metal part such as an automobile body or large appliance goes through a coating line, small paint imperfections will be present which are corrected later in a separate

spray booth. This process is called "touch-up". Volatile organic compounds from this repair process may be treated differently than emissions from the main coating line in regulations.

Trade Association - An organization formed by members of an industry to promote the business of the industry as a whole or to encourage scientific and technical advances which will benefit the industry. Government air pollution regulators often talk to trade associations who have an interest in volatile organic compound regulations. Prominent among these are:

American Petroleum Institute
American Society for Testing Materials
Can Manufacturers Institute
Chemical Manufacturers Association
Flexible Packaging Association
Graphic Arts Technical Foundation
International Gas Cleaning Institute
Motor Vehicle Manufacturers Association
National Coil Coaters Association
National Paint and Coatings Association
National Spray Equipment Manufacturers Association
Powder Coating Institute
Rubber Manufacturers Association

Trade journal - A magazine devoted to the interests of a specific industry.

Trade sales - Paint sold as shelf goods through retail outlets to the general public and used mainly for coating of architectural structures.

Traffic paint - Any coating used for traffic control such as to paint centerlines on highways and also for parking lot and curb markings.

Transfer efficiency - The ratio of the amount of coating solids deposited onto the surface of the coated part to the total amount of coating solids used.

Three-piece can - A can made of three different pieces, a body, a top, and a bottom.

Two component paint - A coating which is manufactured in two components which must be maintained separate until shortly before use. When mixed, the two liquids rapidly crosslink to form a solid composition.

Two-piece can - A can which consists of a body and bottom manufactured from a single piece of steel or aluminum and a separate top which is attached to the body.

Units - In air pollution regulatory usage, units are the dimentional quantities such as length, weight, or volume in which an air pollution regulation or a guideline is expressed. In the series of

reports known as Control Techniques Guidelines, suggested RACT levels are given in units of "lbs of VOC per gallon of coating (less water)". The metric euivalent of this can also be used: "Kg of VOC per liter of coating (less water)". For new source performance standard regulations, units of "Kg of VOC per liter of coating solids" have been used. These latter units permit easier consideration of transfer efficiency in any calculations that are required. Figure B-1, in Appendix B, allows rapid calculation of the solvent content, in pounds of VOC/gallon of coating (less water) of three important types of coatings when the volume percent solids is known.

Urethane coating - A one or two part coating which contains polyisocyanate monomer and a hydroxyl-containing material which react during cure to form polyurethane. The basis reaction is:

$$R_1NCO + R_2OH \rightarrow R_1NHCOOR_2.$$

Ultraviolet (UV) - Electromagnetic radiation of wavelength between 10 and 400 nanometer. Sources of UV are used to cure coatings which are specially designed for this purpose.

Vapor capture system - Any combination of hoods and ventilation system that captures or contains organic vapors in order that they may be directed to an abatement or recovery device.

Varsol - The brand name of Exxon produced mineral spirits. Varsol is often used as the solvent in print paste for fabric painting.

Vinyl plastisol - An emulsion of polyvinyl chloride (PVC) resin, plasticizers, emulsifiers and stabilizers. It might contain a small amount of diluent, 1-5 percent, for viscosity control.

Vinyl printing ink - Any mixture or solution containing a polymeric resin and dye or pigment which is applied in decorative patterns to vinyl sheets or coated webs using a rotogravure printing process.

Vinyl printing and top-coating - The application of a decorative pattern to a vinyl sheet or coated web with a rotogravure type printing press. Frequently a thin, protective top coat is applied by the last print head of the press.

Viscosity - A measure of a coating's resistance to flow.

VOC - See volatile organic compound.

Volatile Organic Compound (VOC) - Any organic compound which participates in atmospheric photochemical reactions; that is, any organic compound other than those which the Administrator designates as having negligible photochemical reactivity. VOC may be measured by a reference method, an equivalent method, an alternative method or by procedures specified under any subpart. A reference method,

an equivalent method, or an alternative method, however, may also measure nonreactive organic compounds. In such cases, an owner or operator may exclude the nonreactive organic compounds when determining compliance with a standard. The Administrator has designated the following organic compounds as negligibly reactive: methane, ethane, 1,1,1-trichloroethane (methyl chloroform), methylene chloride, trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), chlorodifluoromethane (CFC22), trifluoromethane (FC-23), trichlorotrifluoroethane (CFC-113), dichlorotetrafluoroethane (CFC-114), and chloropentafluoroethane (CFC-115).

Volume percent solids - The portion of a coating which remains as part of the cured film expressed as percent by volume. This contrasts to another convention of expressing solids content by weight percent. Often a percentage is given without specifying whether volume or weight. This is confusing and leads to errors in coating calculations. Figure B-1 in Appendix B allows quick estimation of the solvent content, in pounds of VOC per gallon of coating (less water), when the volume percent solids is known.

Washcoat - A wood furniture coating which is applied after the body stain. It seals the wood surface and stiffens the wood fibers for subsequent sanding.

Waterborne coating - A coating which contains more than five weight percent water in its volatile fraction.

Waterwash spray booth - A spray booth in which water is used to collect overspray. Ventillation air is drawn through the water and paint overspray is captured in the water from which it can be recovered as sludge. The waterwash may help the booth to be kept free of overspray buildup and may reduce the necessity of frequent cleanings.

Weather resistance - The ability to undergo exposures to weather without failure, which is an important paint characteristic. Many new paints are tested by exposure to weather for several years before the paint is judged acceptable for specific use.

Web coating - Coating of fabric, paper, plastic film, metalic foil, metal coil or other products which are flexible enough to be unrolled from a large roll, coated by blade, roll coating or rotogravure as a continuous sheet and, after cure, rerolled.

Weight percent solids - The portion of a coating which remains as part of the cured film expressed as percent by weight. This contrasts to another convention of expressing content by volume percent.

APPENDIX A

SURFACE COATING EMISSION CALCULATIONS

How to Determine

- The volume of coating needed to do a particular job
- The difference (expressed as a percentage) in emissions between two coatings
- The emission reduction (expressed as a percentage) needed to meet an emission limit
- The effect of improvements in transfer efficiency

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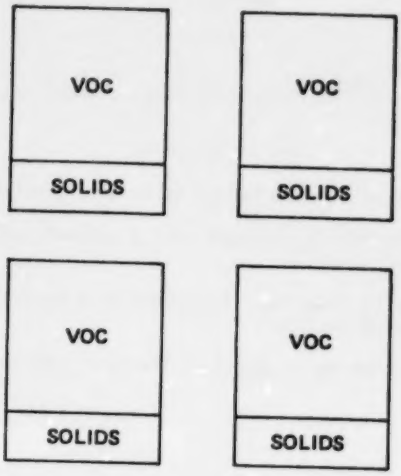
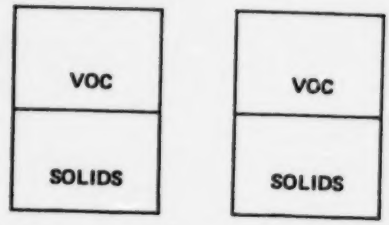
- HOW MUCH COATING IS NEEDED TO DO A PARTICULAR JOB?

The same volume of coating solids must be deposited on an object to coat it to a desired film thickness regardless of the type of coating or volatile organic compound content of the coating used. Solids make the film. Volatiles (VOC, water, and non-photochemically reactive solvents) evaporate.

Four gallons of a 25 volume percent (v/o) solids coating must be used to get one gallon of coating solids.



But, only two gallons of a 50 v/o solids coating must be used to get one gallon of coating solids.

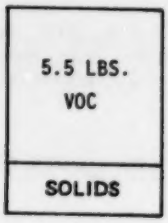


This means that twice as much work can be done with a gallon of 50 v/o solids coating than with a gallon of 25 v/o solids coating. Twice as many gallons of 25 percent solids coating are needed than gallons of 50 percent solids coating to do the same job.

- HOW DO EMISSIONS FROM DIFFERENT COATINGS COMPARE?

Comparisons of the percent difference in emissions between two coatings, or between a coating and an emission limit, must be done on a solids basis.

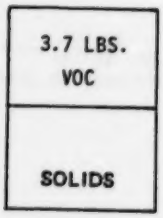
Each gallon of the 25 v/o solids coating contains 5.5 pounds of VOC.



So, for each gallon of coating solids, 22.0 pounds of VOC are emitted.

$$\frac{5.5 \text{ pounds VOC}}{\text{gallon coating}} \quad X \quad \frac{4 \text{ gallons coating}}{\text{gallon solids}}$$

Each gallon of the 50 v/o solids coating contains 3.7 pounds of VOC.



So, for each gallon of coating solids, 7.4 pounds of VOC are emitted.

$$\frac{3.7 \text{ pounds VOC}}{\text{gallon coating}} \times \frac{2 \text{ gallons coating}}{\text{gallon solids}}$$

Thus, emissions from the 50 v/o solids coatings are 66 percent less than from the 25 v/o solids coating when providing an equal amount of solids to the process.

$$\frac{22.0 - 7.4}{22.0} = 0.66$$

- WHAT EMISSION REDUCTION IS NEEDED TO MEET AN EMISSION LIMIT?

This calculation, which must also be done on a solids basis, is the same as that used above to compare emissions from two different coatings.

A coater who uses a 25 v/o solids coating containing 5.5 pounds of VOC per gallon, less water, must reduce emissions by 66 percent to meet an emission limit of 3.7 pounds of VOC per gallon, less water.

- HOW MUCH DO IMPROVEMENTS IN TRANSFER EFFICIENCY HELP A SOURCE TO COMPLY?

The coater may want to use a coating that does not comply with a regulation and compensate by improvements in the transfer efficiency with which the coating is applied to meet an equivalent emission level. In order to calculate credit for VOC reductions which result from improvements in transfer efficiency, calculations should be done using units of:

$$\frac{\text{lb VOC}}{\text{gallon solids deposited}}$$

These units are determined by dividing lb VOC/gallon solids by the transfer efficiency expressed as a decimal fraction. For example, if the starting transfer efficiency is 60 percent, the units would be:

$$\frac{\text{lb VOC}}{\text{gal solids deposited (with the old system)}} = \frac{\text{lb VOC}}{\text{gal solids in coating used}} \times \frac{1.0 \text{ gal solids in coating used}}{0.60 \text{ gal solids deposited}}$$

If the same paint were now to be sprayed with 90 percent transfer efficiency, the new value would be:

$$\frac{\text{lb VOC}}{\text{gallon solids deposited (with new system)}} = \frac{\text{lb VOC}}{\text{gallon solids in coating used}} \times \frac{\text{1.0 gal solids in coating used}}{\text{0.90 gal solids deposited}}$$

If both the solvent content of the coating and the transfer efficiency are changed, the situation becomes:

$$\frac{\text{lb VOC}}{\text{gal solids deposited (with new paint and new transfer efficiency)}} = \frac{\text{lb VOC}}{\text{gal solids in new coating used}} \times \frac{\text{1.0 gal solids in new coating used}}{T \text{ gal solids deposited}}$$

where T = the new transfer efficiency expressed as a decimal

Expressed in these units, the emissions from the old and new systems can be directly compared to determine the reduction achieved.

NOTE: For metal furniture and appliance coating, the EPA has recommended* that credit for transfer efficiency be given from a baseline of 60 percent transfer efficiency (TE). For example, if a company goes from 35 percent TE to 85 percent TE, credit should only be given for going from 60 percent TE to 85 percent TE to avoid rewarding a source that has historically had poor transfer efficiency - hence a high emission rate.

The rationale for this is that 60 percent TE is a reasonable transfer efficiency to achieve for these industries, and credit should only be given for exceeding 60 percent TE.

For the automobile industry, the CTG recommendation for baseline transfer efficiency is 30 percent TE for both primer surfacer and topcoat. This is the efficiency at which waterborne coatings were applied at two existing assembly plants.

* Memo from G. T. Helms, Chief, Control Programs Operations Branch, EPA, to Chief, Air Programs Branch, EPA Regions I-X, "Appropriate Transfer Efficiencies for Metal Furniture and Large Appliance Coating", November 28, 1980.

APPENDIX B

RAPID CONVERSION AIDS*

* The graphs in this appendix are based on graphs on Page 1-4 and on Page D-4 in "Control of Volatile Organic Emissions from Existing Stationary Sources - Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobile, and Light-duty Trucks, EPA-450/2-77-008, May, 1977

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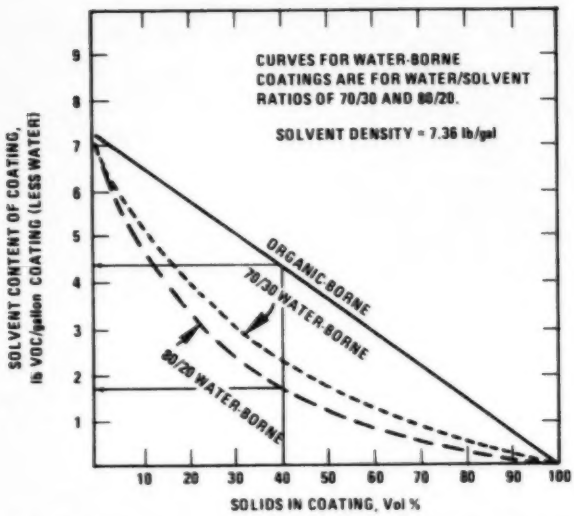

Figure B-1. Approximate weight of organic solvent per gallon of coating (less water) for three coatings as a function of solids content. (A 40 volume percent solids coating could contain as little as 1.7 pounds of VOC per gallon of coating (less water) if it is of the 80/20 water-borne type, or as much as 4.4 pounds for an organic-borne coating).

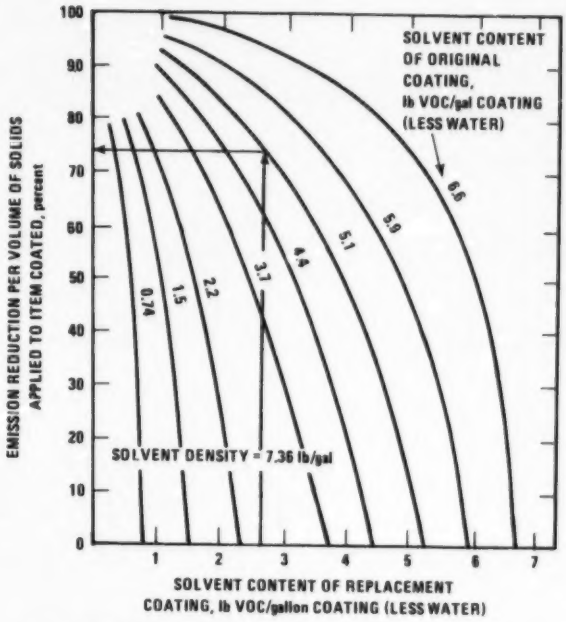

Figure B-2. Approximate reduction in emissions which occurs by replacing a higher solvent coating with one of lower solvent content. (In the example above, a 74 percent reduction in emissions can be obtained by replacing a coating with a solvent content of 5.1 pounds of VOC per gallon, less water, with a coating which contains 2.8 pounds of VOC per gallon, less water).

APPENDIX C

EXAMPLES OF DETERMINING COMPLIANCE ALTERNATIVES USING GRAPHICAL AIDS

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EXAMPLES OF COMPLIANCE SITUATIONS

CASE 1

SITUATION:

A company using an organic-borne coating with a VOC content of 5.1 lbs. of VOC per gallon of coating (less water) must comply with a State regulation that limits it to 2.8 lbs. of VOC per gallon of coating (less water). What are the company's options for compliance?

RAPID DETERMINATION OF ALTERNATIVES

STEP 1 - Figure C-1 (which is equivalent to Figure B-1 in Appendix B) indicates three coatings that meet the 2.8 lb VOC/gallon of coating (less water) regulation: An 80/20 waterborne coating with 24 volume percent solids, a 70/30 waterborne coating with 33 volume percent solids, and an organic-borne coating with 62 volume percent solids. Conversion of the process to use any of these would comply with the regulation.

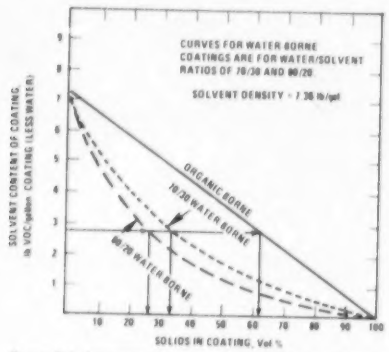
CURVES FOR WATER BORNE COATINGS ARE FOR WATER/SOLVENT RATIOS OF 70/30 AND 80/20
SOLVENT DENSITY = 7.36 lb/gal
ORGANIC BORNE
70/30 WATER BORNE
80/20 WATER BORNE
SOLVENT CONTENT OF COATING, lb VOC/gallon COATING (LESS WATER)
SOLIDS IN COATING, Vol %

Figure C-1. Approximate weight of organic solvent per gallon of coating (less water) for three coatings as a function of solids content.

STEP 2 - If compliance with an add-on control device such as an incinerator or carbon adsorber is desired (instead of changing the coating) use Figure B-2 in Appendix B to determine that a change from a coating with 5.1 lb VOC per gallon of coating (less water) to one with 2.8 lb VOC per gallon (less water) represents about a 74 percent reduction in emissions. Any combination of capture device and control system that will achieve an overall 74 percent reduction would be an equivalent compliance scheme.

CAUTION - Avoid the erroneous tendency to calculate the required reduction in Step 3 by this method:

$$\frac{5.1 - 2.8}{5.1} \times 100\% = 45\%$$

Such a calculation does not truly compare the relative amounts of VOC needed to apply the same volume of coating solids.

CASE 2

SITUATION:

A company using an organic-borne coating with a solvent content of 30 volume percent solids must comply with a State regulation that limits it to 2.8 lbs of VOC per gallon of coating (less water). What are the company's option's for compliance?

RAPID DETERMINATION OF ALTERNATIVES

STEP 1 - Use Figure C-2 (which is equivalent to Figure B-1 in Appendix B) to find that an organic-borne coating with 30 volume percent solids contains 5.1 lbs. of VOC per gallon of coating less water. (Obviously, the company is not currently in compliance with the regulation.)

From this point, the example is identical with the situation in CASE 1. Go to Step 1 in CASE 1 and proceed through that example.

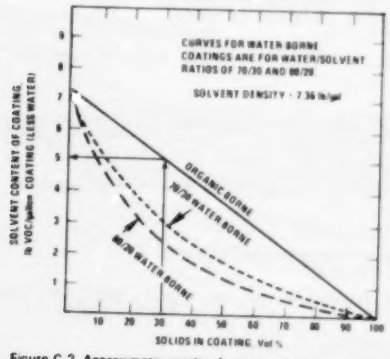
CURVES FOR WATER BORNE COATINGS ARE FOR WATER/SOLVENT RATIOS OF 70/30 AND 80/20
SOLVENT DENSITY - 7.36 lb/gal
ORGANIC BORNE
70/30 WATER BORNE
80/20 WATER BORNE
SOLVENT CONTENT OF COATING lb VOC/gallon COATING (LESS WATER)
SOLIDS IN COATING Vol %

Figure C-2. Approximate weight of organic solvent per gallon of coating (less water) for three coatings as a function of solids content.

CASE 3

SITUATION:

A coating plant with several coating lines is currently using 100 gallons/day of a 5.1 lb VOC/gallon (less water) conventional solvent-borne coating to coat a given output of products, but the company must now comply with a State regulation that limits it to 2.8 lbs of VOC per gallon of coating (less water).

The company want to calculate the daily maximum VOC emissions from the plant that will be permitted by the new regulation at their current production rate. The plant is located in a State that will permit the emissions from all lines to be considered as a "bubble." The company wants to vary the amounts of solvent used on each coating line, but in such a way that the total daily maximum allowable emissions for the whole plant are never exceeded.

Calculate the daily allowable emissions under this "bubble."

STEP 1- Remember that essentially all equivalency calculations must be based on the volume of coating solids not volumes of coating.

STEP 2- Figure C-2 shows that the existing 5.1 lb VOC/gal coating contains approximately 30 volume percent solids. Therefore, the amount of coating solids sprayed each day is equal to:

$$100 \text{ gal coating/day} \times \frac{0.30 \text{ gal solids}}{\text{gal coating}} = 30 \text{ gal solids/day}$$

STEP 3 - Figure C-1 shows that a solvent-borne coating complying with the 2.8 lb VOC/gal of coating (less water) limitation contains 62 volume percent solids.

STEP 4 - The amount of solids required at a constant production rate will be the same (30 gallons solids/day) regardless of whether the original or the complying coating is used.

For the complying coating, the usage rate in gallons of coating required is:

$$\text{gal coating required} = 30 \frac{\text{gal of solids applied}}{\text{day}} \times \frac{1 \text{ gal complying coating}}{0.62 \text{ gal solids}}$$

$$\text{gal coating required} = 48.4 \text{ gal complying coating needed/day}$$

STEP 5 - Calculate the allowable emissions.

$$\text{Allowable emissions} = \frac{2.8 \text{ lb VOC}}{\text{gal complying coating}} \times 48.4 \frac{\text{gal complying coating}}{\text{day}}$$

$$= 135 \text{ lb VOC/day}$$

CAUTION - Avoid the error of calculating allowable emissions in the following way:

$$100 \text{ gal/day} \times 2.8 \frac{\text{lb VOC}}{\text{gal}} = 280 \text{ lb VOC/day}$$

This is incorrect and allows a high emission rate which is not in compliance with the regulation.